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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 0904

Application Number: 09/334,671
Filing Date: June 17, 1999
Appellant(s): ROUGEOT ET AL.

George J. Primak
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 16 August 2004.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

Claim 13 has been canceled (see 9 June 2003 amendment).

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

It has been noted that appellant indicates that a declaration under 37 CFR 1.132 was filed on 28 January 2004.

The declaration under 37 CFR 1.132 filed 28 January 2004 is insufficient to overcome the rejection of claims 1-5, 14, and 20 based upon Morton in view of Perez-Mendez and Schiebel *et al.* applied under 35 U.S.C. 103 as set forth in the last Office action because: it refers only to invention and not to claims and it is also untimely.

It refer(s) only to the system described in the above referenced application and not to the individual claims of the application. Thus, there is no showing that the

objective evidence of nonobviousness is commensurate in scope with the claims. See MPEP § 716.

Further it should be noted that affidavits and declarations submitted under 37 CFR 1.132 and other evidence traversing rejections are considered timely if submitted after final rejection and submitted with a satisfactory showing under 37 CFR 1.116(b) or 37 CFR 1.195.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant argues (third paragraph on pg. 13 of appeal brief filed 16 August 2004) that in "regard to claim 20 that it should receive separate consideration because it defines a scintillator made from sodium-doped cesium iodide or from materials emitting in the blue spectrum". Thus, appellant's statement in the brief that certain claims do not stand or fall together is not agreed with because merely pointing out differences in what the claims cover is not an argument as to why the claims are separately patentable.

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5,132,539	KWASNICK et al.	7-1992
5,396,072	SCHIEBEL et al.	3-1995

5,596,198	PEREZ-MENDEZ	1-1997
5,693,947	MORTON	12-1997
5,880,472	POLISCHUK et al.	3-1999
6,128,362	BRAUERS et al.	10-2000

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

(A) Claims 1-5, 14, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Perez-Mendez (US 5,596,198) and Schiebel et al. (US 5,396,072). First it should be noted that "thin" has been defined in the specification (pg. 4, line 14) as 2-50 μm. Morton discloses (Figs. 6 and 7) an indirect x-ray image detector suitable for radiology, comprising:

(a) an active matrix substrate (102, FET 31) with scanning and read-out circuits (see Fig. 2);

(b) a co-planar thin photoreceptor (*e.g.*, a 2 μm thick intrinsic a-Si:H semiconductor layer 201; column 8, lines 45-51) deposited over said active matrix substrate (102, FET 31);

(c) a light-transparent biasing electrode (202) covering said photoreceptor (201); and

(d) an x-ray conversion scintillator (*e.g.*, a 300 μm thick columnar caesium iodide material 300; column 8, lines 45-51) on top of said light-transparent biasing electrode (202), wherein said x-ray conversion scintillator (300) converts x-radiation (or γ-radiation) to optical radiation (column 7, lines 33-35),

wherein the active matrix substrate is a two dimensional array of amorphous silicon thin film transistors (*i.e.*, a-Si:H field effect transistor FET 31; column 7, lines 15-17 and column 1, lines 24 and 25) associated with a storage capacitance (10, 20) and having conduction pads with electric connection to the photoreceptor (201), wherein the storage capacitance (10 formed by drain electrode 134 and pixel electrode 103, 20 formed by electrode 202 and electrode 101) is a part of the TFT (thin film transistor) architecture (FET 31) or is an integral part of the photoreceptor (201).

While Morton also discloses (column 10, line 35 to column 11, line 18) a " ... radiation converter ... incorporating: ... (i) scintillators irradiating semiconductor layers, where the semiconductor layer forms the capacitance C_2 ... ", the detector of Morton lacks an explicit description that the radiation converter (*i.e.*, semiconductor layers being irradiated by scintillators) comprise a thin (*e.g.*, 5-20 μm thick) amorphous selenium multilayer structure being blue spectrum irradiated by a cesium iodide material doped with sodium.

However, semiconductor layers (*i.e.*, semiconductor detectors) being irradiated by scintillators (*e.g.*, cesium iodide scintillators) are well known in the art. For example, Perez-Mendez teaches (column 6, lines 60-67) that semiconductor layers selectable from a group of materials of like properties such as multilayer (*i.e.*, p-i-n) detectors formed of a-Si:H or alternatively amorphous selenium are irradiated by scintillators selectable from known scintillators (*e.g.*, cesium iodide doped with sodium with a predominantly blue emission; column 3, lines 45-48; column 6, lines 2-21).

Further, the properties of semiconductor p-i-n detectors are known in the art. For example, Schiebel *et al.* teach (Fig. 3b) that an amorphous selenium p-i-n detector (32, blocking layers 31, 33) or an amorphous selenium n-i-p detector (*i.e.*, where the blocking layers are interchanged; column 6, lines 50-56) have properties wherein the n-layer functions as a hole blocking layer (column 5, lines 43-46) and the p-layer functions as an electron blocking layer (column 5, lines 29-33) and thus a p-i-n structure (or n-i-p structure) have the property of minimizing charge injection from the electrodes resulting in reduced dark current (column 1, line 58 to column 2, line 1).

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a known p-i-n detector structure (*e.g.*, thin amorphous selenium p-i-n or n-i-p) as the semiconductor layers in the detector of Morton, in order to detect the emission from a known scintillator (*e.g.*, sodium doped cesium iodide with a predominantly blue emission) while reducing dark current by minimizing charge injection from the electrodes.

(B) Claims 6-11, 15-17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Perez-Mendez (US 5,596,198) and Schiebel et al. (US 5,396,072) as applied to claim 1 above, and further in view of Polischuk et al. (US 5,880,472).

In regard to claims **6** and **7** which are dependent on claim 1, the modified detector of Morton lacks that the amorphous selenium i-layer is doped with chlorine (*e.g.*, 1-100 ppm) and arsenic (*e.g.*, 0.1-5%). However, semiconductor device fabrication techniques are well known in the art. For example, Polischuk *et al.* teach

(column 7, lines 9-12) that an i-layer of amorphous selenium is normally doped with chlorine (*e.g.*, 1-100 ppm) and arsenic (*e.g.*, 0.1-5%) to function as the photoconductive layer. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide an i-layer of amorphous selenium that is doped with chlorine (*e.g.*, 1-100 ppm) and arsenic (*e.g.*, 0.1-5%) in the modified detector of Morton, in order for the i-layer to function as a photoconductive layer as taught by Polischuk *et al.*

In regard to claim **8** which is dependent on claim 6, the modified detector of Morton lacks a n-layer that is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal. However, semiconductor device fabrication techniques are well known in the art. For example, Schiebel *et al.* also teach that the n-layer is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal (column 5, lines 46-49) in order to minimize charge injection from the electrodes so as to reduce dark current (column 1, line 58 to column 2, line 1). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a n-layer that is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **9** which is dependent on claim 8, the detector of Morton lacks that the alkaline metal is selected from lithium, sodium, potassium and cesium. However, semiconductor device fabrication techniques are well known in the art. For

example, Schiebel *et al.* also teach that the alkaline metal is selected from lithium, sodium, potassium and cesium (column 5, lines 46-49). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a n-layer that is a thin selenium layer doped with an alkaline metal (*e.g.*, lithium, sodium, potassium, cesium) or an oxide or halogenide of said metal in the detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **10** which is dependent on claim 6, the modified detector of Morton lacks that the p-layer that is a thin layer of arsenic enriched amorphous selenium. However, semiconductor device fabrication techniques are well known in the art. For example, Polischuk *et al.* also teach that the p-layer is a thin layer of arsenic enriched amorphous selenium (column 9, lines 16-21) in order to minimize charge injection from the electrodes (column 7, lines 22-30). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a p-layer that is a thin layer of arsenic enriched amorphous selenium in the modified detector of Morton, in order to minimize charge injection from the electrodes as taught by Polischuk *et al.*

In regard to claim **11** which is dependent on claim 10, the modified detector of Morton lacks a p-layer with an arsenic enrichment of 1-38% by wt. However, semiconductor device fabrication techniques are well known in the art. For example, Polischuk *et al.* also teach that the arsenic enrichment of the p-layer is 1-38% by wt (column 9, lines 16-21) in order to minimize charge injection from the electrodes

(column 7, lines 22-30). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a p-layer that is a thin layer of arsenic enriched amorphous selenium in the modified detector of Morton, in order to minimize charge injection from the electrodes as taught by Polischuk *et al.*

In regard to claim **15** which is dependent on claim 6, the modified detector of Morton lacks that the electrode is formed by indium tin oxide. However, electrodes such as indium tin oxide electrodes are well known in the art. For example, Polischuk *et al.* teach (column 7, lines 9-12) that the light transparent biasing electrode is a co-planar indium tin oxide (ITO) layer (column 9, lines 39-44) which is well known in the art (column 4, lines 29-38) and commercially available (column 9, lines 10-13). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a known commercially available electrode (*e.g.*, an indium tin oxide electrode) for the electrode in the modified detector of Morton.

In regard to claim **16** which is dependent on claim 6, the modified detector of Morton lacks a selenium based multilayer structure that is of the p-i-n type and the light transparent biasing electrode is set to a negative potential. Schiebel *et al.* also teach that the selenium based multilayer structure is of the p-i-n type and the light transparent biasing electrode is set to a negative potential (*i.e.*, blocking layers are interchanged for a p-i-n structure when negative voltage is applied to bias electrode; column 6, lines 50-56). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a selenium based multilayer structure that is of the p-i-n type and the light transparent biasing electrode is set to a negative potential in the

modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **17** which is dependent on claim 6, Morton also teaches (Fig. 1) that a high voltage protective device (D1, D2) is also provided shunting the storage capacitance (column 6, lines 33-37).

In regard to claim **19** which is dependent on claim 1, the modified detector of Morton lacks an explicit description that the selenium based multilayer structure is optimized for minimum dark current and residual image. However, Morton also teaches that it is desirable for the radiation converter (*e.g.*, a selenium based multilayer structure) to have little or no image lag (*i.e.*, residual image; column 11, lines 53-55). Further, it is known in the art that residual image is due to dark current and modulated space charge. For example, Schiebel *et al.* teach that the selenium based multilayer structure is optimized for electrical transport without significant dark current which is defined as 1 pA/cm^2 (*i.e.*, where dark current is below 200 pA/cm^2; column 5, lines 62-66). As another example, Polischuk *et al.* teach that by blocking charge injection from the electrodes, both dark current and modulation of space charge (*i.e.*, residual image) can be minimized (column 13, lines 2-44; column 14, lines 1-20; see also Fig. 8b which shows minimal image lag in comparison to Fig. 8a). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to optimize the selenium based multilayer structure in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to minimize dark current (*i.e.*, below 200 pA/cm^2) and residual image (*i.e.*, less than 5%).

(C) Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Perez-Mendez (US 5,596,198), Schiebel et al. (US 5,396,072), and Polischuk et al. (US 5,880,472) as applied to claim 6 above, and further in view of Brauers et al. (US 6,128,362). The modified detector of Morton lacks that each of the n and p layers is less than 1 μm in thickness. Schiebel *et al.* also teaches an example of where the n layer (*i.e.*, hole blocking) has a thickness of 0.5 and 2 μm. Brauers *et al.* teach that blocking layers can be thin but the doping must be increased to compensate for a thinner blocking layer and provides an example of where the p layer (*i.e.*, electron blocking) has a thickness of 0.1 to 50 μm (column 5, lines 5-14). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide blocking layers of thickness less than 1 μm with appropriate doping in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current.

(D) Claims 18 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Perez-Mendez (US 5,596,198) and Schiebel et al. (US 5,396,072) as applied to claim 1 above, and further in view of Kwasnick et al. (US 5,132,539).

In regard to claim **18** which is dependent on claim 1, the modified detector of Morton lacks a biasing electrode which also serves to match indices of refraction of the scintillator and the selenium based multilayer structure. Kwasnick *et al.* teach that the indices of refraction of the scintillator and the photodetector should be matched in order for the photons to readily pass from the scintillator into the photodetector (column 3,

lines 16-24). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to form the biasing electrode in the modified detector of Morton with an optical index matching substance, in order for the photons to readily pass from the scintillator into the selenium based multilayer structure as taught by Kwasnick *et al.*

In regard to claim **21** which is dependent on claim 1, the modified detector of Morton lacks a housing. Kwasnick *et al.* teach (column 1, line 17 to column 2, line 45) that it is known in the art to provide a housing enclosing an imaging array in order to protect the imaging array from the ambient environmental and to hermetically seal the housing to provide protection in high humidity environments. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a housing in the modified detector of Morton, in order to protect the detector from the ambient environmental.

(11) Response to Argument

Response to Issue A Arguments

Appellant argues (first paragraph on pg. 7 of appeal brief filed 16 August 2004) that Morton does not describe nor suggest an indirect x-ray image detector suitable for radiology that uses a photoreceptor made of a co-planar thin layer of amorphous selenium-based multilayer structure that would absorb light thereby converting the indirect incident energy into electrical charges and that this basic difference has been admitted by the Examiner. Examiner respectfully disagrees.

Morton states (column 10, line 35 to column 11, line 18) that "Accordingly, the radiation converter may take a variety of different forms depending upon the application to which the radiation detector is being put, including converters incorporating: ... (i) scintillators irradiating semiconductor layers, where the semiconductor layer forms the capacitance C_2. ... A particular advantage of the described radiation detectors is that while the radiation converter may have a variety of different forms, as described herein, the structure defining the capacitors 10 and the readout circuitry 30 with which the converter is used requires no significant modification. Accordingly, experimentation using different kinds of radiation converter is relatively straightforward. The radiation detectors which have been described have the same general structure, namely an array of discrete electrodes each defining a respective pixel in the image that is to be formed and comprising part of a respective first capacitor, a second capacitor incorporating a radiation converter and read-out circuitry for reading out a signal representative of charge that accumulates on the discrete electrodes of the first capacitors in response to radiation detected by the radiation converter" and (column 1, lines 8-10) that this "invention has particular, though not exclusive application to such detectors used for medical imaging; for example, medical X-radiation imaging". Thus Morton explicitly teaches an indirect x-ray image detector suitable for radiology that uses a photoreceptor made of a semiconductor structure that would absorb light thereby converting the indirect incident energy into electrical charges and that experimentation using different kinds of radiation converter (*e.g.*, different semiconductors and/or scintillators) is relatively straightforward.

Further, semiconductor layers (*e.g.*, a-Si:H or amorphous selenium) being irradiated by scintillators (*e.g.*, sodium doped cesium iodide with a predominantly blue emission) are well known in the art (as exemplified by Perez-Mendez). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a known p-i-n detector (*e.g.*, thin amorphous selenium p-i-n or n-i-p) structure as the semiconductor layers in the detector of Morton, in order to detect the emission from a known scintillator (*e.g.*, sodium doped cesium iodide with a predominantly blue emission).

Appellant argues (second paragraph on pg. 7 of appeal brief filed 16 August 2004) that all of the semiconductors and similar materials in Morton (column 10, line 35 to column 11, line 18) are useful for detecting α, β, γ, and x-ray radiation and that there is no indication whatsoever in Morton that they can be used as photoconductors suitable to absorb light. Examiner respectfully disagrees. As discussed above, Morton explicitly teaches (column 10, line 35 to column 11, line 18) a radiation converter incorporating scintillators irradiating semiconductor layers. Morton also states (column 7, lines 33-53) that " ... the radiation detector also comprises a layer 300 of a scintillator, caesium iodide (CsI) having a columnar structure. Layer 300 does not form part of the dual capacitive structure 10,20, but converts radiation that is to be detected (e.g. x-radiation or γ-radiation) to optical radiation, the intensity of optical radiation produced being dependent on the intensity of radiation to which layer 300 is exposed. Optical radiation produced in this way, passes through layer 300 and into layer 201 of the second capacitor 20. ... Individual photons entering layer 201 create

electron-hole pairs in the semiconductor material of the layer ... ". Thus the semiconductors (*e.g.*, semiconductor layer 201) being irradiated by scintillators (*e.g.*, scintillator layer 300) in Morton are suitable for absorbing light (*i.e.*, optical radiation) from the scintillators and to convert this optical radiation into electrons and holes (*i.e.*, photoconducting charges).

Appellant argues (third paragraph on pg. 7 to third paragraph on pg. 9 of appeal brief filed 16 August 2004) that Morton's radiation detector can in no way be compared to Appellant's indirect x-ray detector either by way of structure or by way of principle of operation since Morton's photoreceptor 201 is pixelated.

First, it should be noted that pixel is defined[1] as "The smallest image-forming unit of a video display". Morton states (column 11, lines 31-39) that "The radiation detectors which have been described have the same general structure, namely an array of discrete electrodes each defining a respective pixel in the image that is to be formed and comprising part of a respective first capacitor, a second capacitor incorporating a radiation converter and read-out circuitry for reading out a signal representative of charge that accumulates on the discrete electrodes of the first capacitors in response to radiation detected by the radiation converter". Thus it is clear that Morton teach that each electrode of the array of discrete electrodes <u>define</u> a respective pixel in the <u>image</u> (which is consistent with the dictionary definition of a pixel).

However, it appears that appellant is arguing (see third paragraph on pg. 8 of appeal brief filed 16 August 2004) that Morton's photoreceptor 201 is "pixelated" since

there are extra deposits of doped materials around the pixel capacitor that creates means of electronic focusing on the charges. Thus it appears that appellant is using additional structures (203 and 204 in Figs. 6 and 7 of Morton) as indicating that Morton's photoreceptor (201 in Figs. 6 and 7 of Morton) is "pixelated".

In response to appellant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (*i.e.*, non-pixelated or that there are no extra deposits of doped materials) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). It should be noted that independent claim 1 recites the limitation of "an active matrix substrate with scanning and read-out circuits, wherein over said active matrix substrate there is deposited a photoreceptor made of a co-planar thin layer of amorphous selenium based multilayer structure, said photoreceptor being covered with a light-transparent biasing electrode on top of which there is provided an x-ray conversion scintillator". Thus there is no limitation on the photoreceptor as to being non-pixelated or that there are no extra deposits of doped materials.

Appellant argues (last paragraph on pg. 9 of appeal brief filed 16 August 2004) that there is nothing in Perez-Mendez that would even hint at the possibility of using a coplanar thin layer of any kind of a non-pixelated photoreceptor that would be capable to convert light into electrical charges. In response to appellant's argument, the test for

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[1] The American Heritage® Dictionary of the English Language, Third Edition copyright © 1992 by

obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Moreover as discussed above, Morton teach that each electrode of the array of discrete electrodes <u>define</u> a respective pixel in the <u>image</u> (which is consistent with the dictionary definition of a pixel). However, it appears that appellant is arguing (see last paragraph on pg. 9 of appeal brief filed 116 August 2004) that the special resolution in Perez-Mendez comes from a pixilated array of pixel diodes 67-70 with separations 71, 72 therebetween for circuit interconnections (with column 7, lines 60-61 and Fig. 4 cited). Thus it appears that in this particular argument, appellant is using separations (71 and 72 in Figs. 4 and 4A of Perez-Mendez) as indicating that the Perez-Mendez's photoreceptor is "pixelated". In response to appellant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (*i.e.*, non-pixelated or that the layers are continuous without any separations in the layers at the boundaries of each pixel defining electrode) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In response to appellant's argument (first two paragraphs on pg. 10 of appeal brief filed 16 August 2004) that Schiebel *et al.* is nonanalogous art, it has been held that a prior art reference must either be in the field of appellant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the appellant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Morton, Perez-Mendez, and Schiebel *et al.* are all classified within 250/370.09. Further as discussed above, Morton explicitly teaches an indirect x-ray image detector suitable for radiology that uses a photoreceptor made of a semiconductor structure that would absorb light thereby converting the indirect incident energy into electrical charges and that experimentation using different kinds of radiation converter (*e.g.*, different semiconductors and/or scintillators) is relatively straightforward. Perez-Mendez teaches that semiconductors and/or scintillators are selectable from a known semiconductor group (*e.g.*, an amorphous selenium p-i-n detector) and/or a known scintillator group (*e.g.*, cesium iodide doped with sodium with a predominantly blue emission). Further, the properties of these amorphous selenium p-i-n detectors are known in the art as exemplified by Schiebel *et al.* Therefore, it is clear that Morton, Perez-Mendez, and Schiebel *et al.* are all in the field of appellant's endeavor.

In response to appellant's argument (third paragraph on pg. 10 to second paragraph on pg. 13 of appeal brief filed 16 August 2004) that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the

claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the teaching, suggestion, or motivation to do so found in the references themselves. As discussed above, Morton explicitly teaches an indirect x-ray image detector suitable for radiology that uses a photoreceptor made of a semiconductor structure that would absorb light thereby converting the indirect incident energy into electrical charges and that experimentation using different kinds of radiation converter (*e.g.*, different semiconductors and/or scintillators) is relatively straightforward. Perez-Mendez teaches that semiconductors and/or scintillators are selectable from a known semiconductor group (*e.g.*, an amorphous selenium p-i-n detector) and/or a known scintillator group (*e.g.*, cesium iodide doped with sodium with a predominantly blue emission). Further, the properties of these amorphous selenium p-i-n detectors are known in the art (as exemplified by Schiebel *et al.*) for reducing dark current by minimizing charge injection from the electrodes. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a known p-i-n detector (*e.g.*, thin amorphous selenium p-i-n or n-i-p) structure as the semiconductor layers in the detector of Morton, in order to detect the emission from a known scintillator (*e.g.*, sodium doped cesium iodide with a predominantly blue emission) while reducing dark current by minimizing charge injection from the electrodes.

Appellant argues (third paragraph on pg. 13 of appeal brief filed 16 August 2004) that Morton uses an amorphous silicon photoreceptor which is structured by lithography into pixels covered with thallium-doped cesium iodide yellow emitting scintillator or with a scintillator of another kind to which amorphous silicon is sensitive. Examiner respectfully disagrees since there is no teaching within Morton which suggest that scintillators of sodium-doped cesium iodide or those emitting in blue spectrum are excluded. On the contrary (as discussed above), Morton explicitly teaches an indirect x-ray image detector suitable for radiology that uses a photoreceptor made of a semiconductor structure that would absorb light thereby converting the indirect incident energy into electrical charges and that experimentation using different kinds of radiation converter (*e.g.*, different semiconductors and/or scintillators) is relatively straightforward.

Response to Issue B Arguments

Appellant argues (first paragraph on pg. 14 of appeal brief filed 16 August 2004) that Polischuk *et al.* do not provide any further meaningful material (*i.e.*, suggestion or motivation) since Polischuk *et al.* is directed to direct conversion with a thick layer of doped amorphous selenium. Examiner respectfully disagrees. In response to appellant's argument, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, the suggestion or motivation to use

scintillators irradiating semiconductor layers as the radiation converter is explicitly taught by Morton (as discussed above). Further, it has been clearly established by the art of record that an amorphous selenium detector can be used to detect both x-rays and light. As one example, the disclosure of Polischuk *et al.* (column 1, line 15 to column 4, line 60) teach that it is well known in the art that an amorphous selenium detector can be used to detect both x-rays and light (*e.g.*, see column 3, lines 12-36). In addition, Polischuk *et al.* was cited for teaching that an i- or p- amorphous selenium layer is formed by doping with chlorine and/or arsenic and that a light transparent biasing electrode is formed by a well known in the art and commercially available co-planar indium tin oxide (ITO) layer (column 4, lines 29-38; column 7, lines 9-12; column 9, lines 10-13 and 39-44). Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a known p-i-n detector (*e.g.*, thin amorphous selenium p-i-n or n-i-p wherein the i- or p- layers are formed by doping with chlorine and/or arsenic) structure as the semiconductor layers in the detector of Morton, in order to detect the emission from a known scintillator (*e.g.*, sodium doped cesium iodide with a predominantly blue emission) while reducing dark current by minimizing charge injection from the electrodes.

Response to Issue C Arguments

Appellant argues (second paragraph on pg. 14 of appeal brief filed 16 August 2004) that there is no teaching, suggestion, or motivation expressed in Brauers *et al.* since Brauers *et al.* is directed to direct conversion with a thick layer of doped amorphous selenium. Examiner respectfully disagrees for the reasons

discussed above. Moreover in response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the suggestion or motivation to use scintillators irradiating semiconductor layers as the radiation converter is explicitly taught by Morton (as discussed above). Schiebel *et al.* was cited as teaching an example of where the n layer (*i.e.*, hole blocking) has a thickness of 0.5 and 2 μm and Brauers *et al.* was cited as teaching that blocking layers can be thin but the doping must be increased to compensate for a thinner blocking layer and provides an example of where the p layer (*i.e.*, electron blocking) has a thickness of 0.1 to 50 μm. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a known p-i-n detector (*e.g.*, thin amorphous selenium p-i-n or n-i-p with thin n- or p- layers which are formed by doping with chlorine and/or arsenic) structure as the semiconductor layers in the detector of Morton, in order to detect the emission from a known scintillator (*e.g.*, sodium doped cesium iodide with a predominantly blue emission) while reducing dark current by minimizing charge injection from the electrodes.

Response to Issue D Arguments

Appellant argues (last paragraph on pg. 14 of appeal brief filed 16 August 2004) that Kwasnick *et al.* do not make claim 19 obvious since Kwasnick *et al.* provide a separate layer for index matching in an x-ray image detector where the photoreceptor is not made of amorphous selenium based multilayer structure. In response to appellant's argument, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, Kwasnick *et al.* state (column 3, lines 16-24) that "Scintillator 30 is positioned adjacent to, and is optically coupled to, photodetector array 20. As used herein, "optically coupled to photodetector array 20" refers to arranging the two arrays so that light photons from the scintillator readily pass into photodetectors; the optical coupling may include a separate layer (not shown) of a material, such as an optical index matching substance, which aids in the efficient transfer of the photons from the scintillator to the photodetectors". Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to form the biasing electrode in the modified detector of Morton with an optical index matching substance, in order for the photons to readily pass from the scintillator into the selenium based multilayer structure as taught by Kwasnick *et al.*

Appellant also argues (last paragraph on pg. 14 of appeal brief filed 16 August 2004) that Kwasnick *et al.* do not make claim 21 obvious since Kwasnick *et al.* provide a protective covering only for the scintillator. Examiner respectfully disagrees. Kwasnick *et al.* teach (column 2, lines 18-45; Fig.) that the scintillator (30) and photodetector array (20) is hermetically enclosed by an enclosure comprising cover (50), ring (40), and substrate (15). Thus Kwasnick *et al.* provide more than just a protective covering only for the scintillator. Moreover, Kwasnick *et al.* was cited as teaching (column 1, line 17 to column 2, line 45) that it is known in the art to provide a housing enclosing an imaging array in order to protect the imaging array from the ambient environmental and to hermetically seal the housing to provide protection in high humidity environments. Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to provide a housing in the modified detector of Morton, in order to protect the detector from the ambient environmental.

Response to Conclusion

In response to appellant's argument (second paragraph on pg. 15 of appeal brief filed 16 August 2004) that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the appellant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). While appellant argues that appellant's

invention basically resides in an unexpected finding, appellant fails to provide any evidence that the finding is unexpected. Further as discussed above, the suggestion or motivation to use scintillators irradiating semiconductor layers as the radiation converter is explicitly taught by Morton.

Appellant argues (last paragraph on pg. 15 of appeal brief filed 16 August 2004) that the invention would have been adopted before in view of its advantages if the invention is obvious. Allegations that if the invention is obvious, the invention would have been adopted before in view of its advantages is not persuasive of nonobviousness since alleged non-adoption can be attributable to other factors (*e.g.*, lack of interest or lack of appreciation of an invention's potential or marketability rather than want of technical know-how; see MPEP § 716.06).

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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